

***Evaluation of the Impact of Changes
in the Hours of Service Regulations
on Efficiency, Drivers and Safety***

by

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Disclaimer

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SUMMARY AND CONCLUSIONS

Drivers, carriers, and society in general would appear to experience positive net gains from a change in the cumulative hours of service rules from the current 70-in-8 day rule to a 24-hour restart provision. These positive gains would consist of increased driver income, improved scheduling flexibility, a potential for increased time at home, increased economic efficiency, and improved safety, as well as gains in other areas.

Impact on Efficiency

Efficiency gains would be in the form of increased utilization of equipment, reduced transit time, reduced risk of vandalism and theft, improved scheduling flexibility and improved retention of drivers. Increased equipment utilization will vary by the type of carrier and their policies regarding home time. Gains could range from zero to twenty-five percent or greater. Carriers whose drivers are typically out for two weeks or more at a time would experience significant increases in equipment utilization. This could result in savings to the industry of approximately one billion dollars. This increase in utilization assumes that drivers spend as much time at home after the rule change. The increased utilization is based on the improved productivity of the driver while they are on the road - not on keeping the driver out longer.

A reduction in transit time, resulting in reduced inventory costs and improved service, would correspond with the improved equipment utilization. The improvements would be gained as a result of drivers not having to stay off-duty for 48 or more hours and could be as much as 45 percent in certain cases. Furthermore, consistency in transit time would also be improved in certain situations as well. Shipper/receivers would receive delivery within normal expectations because drivers would not be shut down for two or more days in the middle of a trip between consignor and consignee.

Reduced risk of vandalism and theft would also result from reduced time waiting on the road. This could result in improved reliability of shipments, reduced insurance claims and premiums and an improved working environment for the driver. Forty-six percent of the drivers surveyed for the study thought that the 24-hour rule would result in reduced risk to their tractor, trailer, and cargo.

Improved scheduling flexibility would also result from the 24-hour restart provision. This would improve the ability of drivers and dispatchers alike to meet just-in-time delivery as well as narrow windows of delivery. Furthermore, there are also positive safety implications. Improved scheduling flexibility will allow drivers to maintain a more routinized schedule in some instances, rather than being forced to drive at odd hours to meet delivery schedules because of the restrictiveness of the 70-in-8 rule.

Increased driver retention and reduced turnover could also result from the 24-hour rule. Drivers' expectations are currently inconsistent with their actual experience in terms of income and waiting time. Drivers expected more income and less waiting time when they first started working than they actually realized. The 24-hour rule would impact both of these in a positive manner presumably leading to improved job satisfaction which would in turn reduce turnover.

Impact on Drivers

Drivers thought that the 24-hour rule would result in increased income. Seventy-two percent of the drivers surveyed for this study were of the opinion that there would be a moderate to substantial increase in their income. Estimates of increases ranged from 25 to 56 percent, based on the hypothetical models developed. A more realistic range may be in the 10 to 25 percent range. This increase would depend on several factors including company policies and, most of all, how a driver chose to utilize the improved flexibility.

The 24-hour rule could result in increased time at home. Under this rule, drivers would gain approximately four days in a sixteen day trip which could be spent driving, or at home if the actual mileage driven per trip did not change. This is based on a scenario of a rhythmic schedule found in Models 4A and 4B. Although it is unlikely that drivers would spend all their additional time gained at home, the models define the outer boundaries of what could hypothetically happen. A total of an additional 73 days annually could be used for home time. A number of drivers surveyed, thirty-two percent, also thought that the rule change would result in increased home time. Forty-nine percent thought there would be no change, and eighteen percent thought it would result in a reduction in

home time. The most likely scenario would be a split between increased driving (and corresponding income) and increased time at home.

The 24-hour rule could have a very positive impact on a driver's schedule. The hypothetical models indicated this and it was also supported by the driver survey. A 24-hour rule would eliminate a driver picking up zeros and would also eliminate very limited driving time after two days of off-duty time. Sixty-five percent of the drivers thought the 24-hour rule would improve their schedule while twenty-two percent thought it would have no impact on their schedule.

Additional off-duty time on the road after a driver has rested has a negative impact on the attitudes of a significant number of drivers, forty-nine percent. If a positive relationship exists between safety and drivers' attitude, then the 24-hour rule would presumably improve safety as a result of the decrease in the off-duty time which is presently required by the 70-in-8 rule.

Impact on Safety

Long distance truckload drivers feel strongly that the 24-hour rule would have a positive impact on safety. Fifty-one percent thought the rule would either make safety "much better" or "better" while thirty-three percent thought it would have no impact. A small percentage, sixteen, perceived it would have a negative impact.

Furthermore, nearly forty percent of the drivers indicated that they were negatively impacted by more than 24 hours off-duty when it came to proper rest and acceptable activities. Assuming that this results in a safety problem, this is a significant finding. Additionally drivers felt that other drivers were slightly affected more negatively than themselves in this matter.

A large majority of drivers believed that the 24-hour rule would also improve their schedule. Sixty-five percent perceived a significant to moderate improvement in their schedule as a result of the 24-hour rule. To the extent that an improved driving/work/off-duty schedule would have a positive impact on safety, the 24-hour rule would seem to have a positive impact in this respect.

Site visits to Florida and California to identify safety problems associated with extended and more liberal intrastate hours of service rules proved negative. Additionally, the authors were not able to identify statistical accident data which differentiated between intrastate and interstate operations.

Furthermore, it was concluded that even if data were to exist, it would be statistically meaningless to try and compare intrastate operations with operations governed by federal regulations. Also, not only was no negative accident or other safety evidence regarding more liberal hours of service rules identified, but just the opposite was found, qualitatively speaking. A number of government and industry personnel thought that the more liberal hours of service rules in these states had a positive impact on safety. The same was true for telephone surveys of oil field carriers and the provinces of Alberta and Saskatchewan.

A more rhythmic schedule is more attainable with the 24-hour rule than the 70-in-8 rule. This could also result in improved safety if it puts the schedule more in tune with the drivers circadian rhythm.

Conclusion

It appears that the 24-hour rule could have positive impacts on safety, efficiency of the firm, and the driver. The question will most certainly arise — What are the potential negative impacts? In discussions with drivers and comments on surveys, one negative impact was frequently identified, which was born out by the negative responses to some of the questions. The one simple negative impact that was cited was that the rule would allow companies to push drivers harder. Arguably, this is a possibility. However, it seems that companies that have a long term view would not engage in such a practice. Furthermore, it seems that companies that would operate in such a manner would do so anyway under the present regulations. In fact, many drivers commented that the 24-hour rule would allow them to run legal and that the 70-in-8 rule forces them out of compliance.

In summary, the positive aspects of the 24-hour rule appear to heavily outweigh any potential negative impacts.

INTRODUCTION

The amount of time that a truck driver can spend driving and doing other job related work has been regulated since 1939 by the federal government. The "hours of service" as they are referred to consist of two types: (1) the number of consecutive hours a driver can spend driving and/or doing related work after which they are prohibited from driving; and (2) the maximum number of cumulative hours a driver can put in driving and/or doing related work during a seven or eight day period, after which they cannot drive. Historically, there were probably several reasons for these regulations. Although it is speculative, the reasons could have ranged from preventing companies from requiring drivers to work unusually long hours to preventing drivers from becoming fatigued from working themselves too hard, either of which decreases highway safety.

The current interest in the hours of service regulations has many origins. Logistical efficiency and global competitiveness are two fundamental reasons. The world is quickly being transformed into a global economy through the development of multi-national trading blocs, the continued development of the General Agreement on Tariffs and Trade, and bilateral trade agreements. The recent developments in the North American Free Trade Agreement, the continuing development of a Pan Asian Community, and the development of the European Community have resulted in increased competitiveness of goods and services on a global basis. This in turn has resulted in efforts for companies to become more efficient making them price and service competitive, especially for companies that compete in a world trade environment. Since transportation is a major component of total trade costs, there is pressure for transportation firms to be as cost efficient as possible. Similarly, transportation / logistical service quality is also a major component of competitiveness. Thus, there is an incentive to improve service performance as well. This is also true for companies that compete primarily in the domestic economy. Since hours of service regulations have a significant impact on the economic efficiency of the firm and the quality of service they can provide, there is a natural interest in them.

Another reason for the current interest in the hours of service regulations is the changes that have taken place in our socio-economic system since these rules were adopted. Fifty years ago the

quality of the highway infrastructure was vastly inferior to today's system. The interstate system was barely a vision at that time. The equipment of that time would be considered antique today and the term "armstrong steering" had real meaning. The safety standards and training were much different, and to some extent nonexistent, compared to today's standards. OSHA was not even an administration. A shortage of drivers did not exist and human resource departments were nonexistent or given little attention in companies. The conditions under which people were willing to work in 1939 would be unacceptable by today's standards. Today's work force is much more selective, particularly in areas of employment where there are labor shortages.

An additional reason for the interest in this rule is that there have been dramatic changes in the U.S. business-economic system since these rules were implemented, which either have been directly related to our transportation system or alternatively, have impacted our transportation system. The transportation system, more than ever before, are the arteries of commerce. Truck transportation currently dominates the non-bulk movements within that system. Within the trucking industry the truckload carrier has emerged as a new industry in the past twelve years, replacing the truckload element of the less-than-truckload business. This was the result of the deregulation of the trucking industry in 1980 as well as a realization of true inventory costs by the business community.

The result of all these policy changes and economic forces has been a growing price and service competitive truckload industry, characterized by sophisticated communication systems, including satellite, just in time delivery, narrow delivery windows, and complicated surface network models. All of these changes require operating flexibility to meet the operational realities of the truckload industry while at the same time meeting current safety requirements and improving on them.

Another reason for interest in this regulation is the sheer number of years it has been in effect without being reviewed. Regardless of the reasons for the interest or the history, this regulation is currently under review and changes are being considered - this is the primary reason for this study.

Existing Rules

The "Hours of Service of Drivers" regulations are very lengthy and detailed and are specified in the Code of Federal Regulations, Chapter 111 (10-1-91 Edition) Part 395 (see Appendix A).

Section 395.3 on "Maximum driving and on-duty time" has several pertinent paragraphs. Paragraph (a) relates to consecutive driving and on-duty time and specifies that:

- a. ...no motor carrier shall permit or require any driver used by it to drive nor shall any such driver drive:
 - (1) More than 10 hours following 8 consecutive hours off-duty; or
 - (2) For any period after having been on-duty 15 hours following 8 consecutive hours off-duty

This section relates the number of hours a driver can drive while being on-duty, after which they must be off-duty for a minimum of 8 hours before they can drive. This regulation restricts drivers from driving no more than 10 hours or from driving after being on-duty for more than 15 hours, including driving and non-driving work, after which time they must be off-duty a minimum of 8 hours before they can drive. On-duty time other than driving could include such work activities as loading and unloading, waiting to be dispatched to load and unload, safety inspections, repairing a vehicle, etc. This part of the regulation encourages the driver to rest periodically during their job of driving and related work activities. The "24-hour restart provision" being considered **does not** affect this regulation.

Paragraph (b) regulates the number of driving and work related on-duty hours a driver can accumulate in a seven or eight day period. It should be pointed out that although the regulation specifies a discreet time period for accumulating a maximum number of hours, the cumulative total is a running total and therefore a driver must never exceed the accumulated maximum on a continuous basis. The regulation specifies that

- b. No motor carrier shall permit or require a driver of a commercial motor vehicle to drive, nor shall any driver drive, regardless of the number of motor carriers using the drivers services, for any period after
 - (1) Having been on-duty 60 hours in any 7 consecutive days if the employing motor carrier does not operate every day in the week; or

- (2) Having been on-duty 70 hours in any period of 8 consecutive days if the employing motor carrier operates motor vehicles every day of the week.

This regulation not only prevents a driver from additional driving after putting in 60 or 70 hours working in a seven or eight day period, but also the total work done on the first day, including driving and non-driving work, determines how much driving can be done the ninth day for a carrier that operates seven days a week. A casual reading of the regulation could lead one to believe that drivers operate on eight day, discreet blocks of time but this is not the case. As was stated earlier, a driver must be aware of the running total hours of service and cannot drive after accumulating seventy hours on-duty in any eight day period. If a driver had accumulated 67 hours in the previous seven days, this individual would be limited to three hours of driving time on the eighth day regardless if they had 48 hours off-duty on the sixth and seventh day. It should be pointed out for clarification that a driver can perform unlimited non-driving on-duty work after 70 hours, but cannot drive. It also should be noted that this is unrealistic in a truckload environment and furthermore, conducting non-driving work after 70 hours on-duty decreases the amount of time available for driving in future days. This rule, the 70-in-8, sometimes results in excessive off-duty time on the road, complicates scheduling, inhibits a routine/rhythmic schedule and causes other associated problems relating to the driver, the individual companies, and the industry. The proposed 24-hour restart provision would significantly affect this regulation.

Proposed 24-Hour Restart Provision

This is the same provision that applies to motor carriers and drivers working in oil field service. Paragraph (d) of Section 395.3 states:

- d. In the instance of drivers of motor vehicles used exclusively in the transportation of oil field equipment, including the stringing and picking up of pipe used in pipelines, and servicing of the field operation of the natural gas and oil industry, **any period of 8 consecutive days may end with the beginning of any off-duty period of 24 or more successive hours.***

"The Federal Highway Administration is proposing to amend a portion of the hours of service regulations for commercial motor vehicle drivers. This rulemaking, if promulgated, would permit the

* Bold added.

on-duty time limitation of 60-hours in 7 consecutive days and 70-hours in 8 consecutive days to begin anew after the driver had an off-duty recovery period of 24 consecutive hours or more."¹ (See Appendix B).

If these proposed changes were adopted, drivers would be able to restart a fresh 7 or 8 day period after 24 hours of rest. This would mean that the amount of work they had done prior to the 24-hour rest would not impact their upcoming cumulative hours. Consequently, what a driver did on the eighth previous day would not impact the work they could do on the next day with this amended provision. This would assure a driver was off-duty for 24 hours some time during the eight day period. Drivers and companies, however, would still be required to comply with the consecutive hours of service regulations.

Organization of Report

The remainder of this report is organized into four sections. Section III deals with the various hypothetical analyses. Section IV analyzes the impact on economic efficiency, Section V assesses the impact on drivers. Section VI deals with the safety issue. Copies of the current regulations and proposed changes are found in Appendices A and B respectively. A driver survey and corresponding procedural results can be found in Appendix C. The laws in the states of California, Florida and the provinces of Alberta and Saskatchewan relating to the hours of service for intrastate operations are found in Appendix D.

¹Federal Register/Vol 57, No. 161/Wednesday, August 19, 1992/ Proposed Rule.

DRIVING AND SERVICE HOURS MODELS

Several hypothetical models were developed for the purpose of estimating the impact that a 24-hour restart provision would have on the number of hours a driver could put in, equipment utilization, transit time, restriction in idle time, drivers income, etc. A total of nine models were developed as listed below. All the models were constructed on the basis that the consecutive hours of driving regulations were complied with. These models assume driving is the main emphasis, drivers are paid on a per mile basis, trucks are assigned to drivers, and loads are immediately available. These models are **hypothetical**. Selected models are compared to one another to create five different scenarios, 1-A,B; 2-A,B; 3-A,B; 4-A,B; and 4-A,C.

SCENARIO	MODEL #	MODEL DESCRIPTION
1	1A	Baseline model of 70 hours in 8 days, maximum 10 hours driving time, no other on-duty time
	1B	24-hour rule model, maximum 10 hours driving time, no other on-duty time
2	2A	Baseline model of 70 hours in 8 days, maximum 15 consecutive hours of on-duty time
	2B	24-hour rule model, maximum 15 consecutive hours of on-duty time
3	3A	Baseline model of 70 hours in 8 days, "normal" 15 hour work day
	3B	24-hour rule model, "normal" 15 hour work day
4	4A	Baseline model of 70 hours in 8 days, "normal" 12 hours work day
	4B	24-hour rule model, "normal" 12 hours work day
5	4A	Baseline model of 70 hours in 8 days, "normal" 12 hour work day
	4C	24-hour rule model, 12 hour non-rhythmic work day

In some cases, the models were constructed in such a way that the amount of off-duty time required was exceeded thus providing the driver more off-duty time than required. Each model was developed for a five week period. Although this is a much longer time than many drivers are on the road, it was done to analyze the impact of the 24-hour rule for any period of time from eight to thirty-

five days. The hypothetical nature of these models should be emphasized. The hypothetical approach was used because no useful and/or statistically representative empirical data was available to analyze the impact of this rule. Several models were developed rather than two to allow for a broader and more varied interpretation of the impact that the 24-hour rule might have.

Model 1A assumes that the driver puts in as much driving time as possible under the current 70-in-8 rule and that there is no on-duty time other than driving. Model 1B was constructed to make a comparison under the 24-hour rule using the same assumption. Both models are unrealistic in the sense that it is unlikely that a driver would operate in this manner continuously. However this analysis portrays the extreme cases which are possible under the law.

Models 2A and 2B represent another extreme in scheduling possibilities. Both models were constructed under the assumption that a driver would put in the maximum amount of driving possible within the restrictions of the continuous hours of service rules while still doing a significant amount, five hours, of other work-related on-duty time interspersed throughout the day. This results in a driver putting in a total of 15 hours before going off-duty for eight. Both models are unrealistic in that it is highly unlikely that any driver would put in such a schedule on a continuous basis. As stated earlier, these models define the extremes.

Both scenarios 1 and 2 are non-rhythmic in nature. For instance a driver would be off-duty and working at different times of the day during different days. Models 3A, 3B, 4A and 4B address this issue by developing a schedule in which the driver would work and be off-duty at the same time, or nearly the same time, every day. As with all the models, the consecutive hours of service rules are complied with and these models would seem to be more realistic.

Model 4C, the final model, is non-rhythmic but does maintain a more normal twelve hour work day as opposed to fifteen. This model is compared to 4A in scenario 5.

Each cell in a model represents one day. The numbers and abbreviations in each cell represent the number of hours driving, on-duty but not driving, and off-duty in a total of 24 hours. The beginning time of day is not indicated since it is the prerogative of the motor carrier to determine the time of day in which the beginning log entry is made. Subsequently, one can assume that the first day begins at any time and a 24-hour cycle ensues thereafter for everyday in the model.

10 drv	← Ten hours of driving
2 on	← Two hours of on-duty time other than driving
10 off	← Ten hours off-duty time
2 break	← Off-duty due to being out of hours

Model 1A. Baseline Model of 70 Hours in 8 Days Straight Driving Time, No Other On-Duty Time								
Week	Sun	Mon	Tue	Wed	Thu	Fri	Sat	Weekly Total
I	1 10 drv 8 off 6 drv	2 4 drv 8 off 10 drv 2 off	3 6 off 10 drv 8 off	4 10 drv 8 off 6 drv	5 4 drv 8 off 10 drv 2 break	6 24 break	7 24 break	70 drv
II	8 24 break	9 10 drv 8 off 6 drv	10 4 drv 8 off 10 drv 2 off	6 off 10 drv 8 off	10 drv 8 off 6 drv	4 drv 8 off 10 drv 2 break	24 break	70 drv
III	24 break	24 break	10 drv 8 off 6 drv	4 drv 8 off 10 drv 2 off	6 off 10 drv 8 off	10 drv 8 off 6 drv	4 drv 8 off 10 drv 2 break	70 drv
IV	24 break	24 break	24 break	10 drv 8 off 6 drv	4 drv 8 off 10 drv 2 off	6 off 10 drv 8 off	10 drv 8 off 6 drv	56 drv
V	4 drv 8 off 10 drv 2 break	24 break	24 break	24 break	10 drv 8 off 6 drv	4 drv 8 off 10 drv 2 off	6 off 10 drv 8 off	54 drv

Model 1B. 24-hour Rule Model of Straight Driving, No Other On-Duty Time								
Week	Sun	Mon	Tue	Wed	Thu	Fri	Sat	Weekly Total
I	10 drv 8 off 6 drv	4 drv 8 off 10 drv 2 off	6 off 10 drv 8 off	10 drv 8 off 6 drv	4 drv 8 off 10 drv 2 break	22 break 2 drv	8 drv 8 off 8 drv	88 drv
II	2 drv 8 off 10 drv 4 off	4 off 10 drv 8 off 2 drv	8 off 10 drv 6 off	2 drv 8 off 10 drv 4 break	20 break 4 drv	6 drv 8 off 10 drv	8 off 10 drv 6 off	76 drv
III	2 off 10 drv 8 off 4 drv	6 drv 8 off 10 drv	8 off 10 drv 6 break	18 break 6 drv	4 drv 8 off 10 drv 2 off	6 off 10 drv 8 off	10 drv 8 off 6 drv	86 drv
IV	4 drv 8 off 10 drv 2 off	6 off 10 drv 8 break	16 break 8 drv	2 drv 8 off 10 drv 4 off	4 off 10 drv 8 off 2 drv	8 drv 8 off 8 drv	2 drv 8 off 10 drv 4 off	84 drv
V	4 off 10 drv 10 break	14 break 10 drv	8 off 10 drv 6 off	2 off 10 drv 8 off 4 drv	6 drv 8 off 10 drv	8 off 10 drv 6 off	2 off 10 drv 12 off	80 drv

Model 2A. Baseline Model of 70 Hours in 8 Days Maximum 15 Consecutive Hours of On-Duty Time								
Week	Sun	Mon	Tue	Wed	Thu	Fri	Sat	Weekly Total
I	10 drv 5 on 8 off 1 drv	9 drv 5 on 8 off 2 drv	8 drv 5 on 8 off 3 drv	7 drv 5 on 8 off 4 drv	6 drv 18 break	24 break	24 break	50 drv 20 on
II	24 break	10 drv 5 on 8 off 1 drv	9 drv 5 on 8 off 2 drv	8 drv 5 on 8 off 3 drv	7 drv 5 on 8 off 4 drv	6 drv 18 break	24 break	50 drv 20 on
III	24 break	24 break	10 drv 5 on 8 off 1 drv	9 drv 5 on 8 off 2 drv	8 drv 5 on 8 off 3 drv	7 drv 5 on 8 off 4 drv	6 drv 18 break	50 drv 20 on
IV	24 break	24 break	24 break	10 drv 5 on 8 off 1 drv	9 drv 5 on 8 off 2 drv	8 drv 5 on 8 off 3 drv	7 drv 5 on 8 off 4 drv	44 drv 20 on
V	6 drv 18 break	24 break	24 break	24 break	10 drv 5 on 8 off 1 drv	9 drv 5 on 8 off 2 drv	8 drv 5 on 8 off 3 drv	39 drv 15 on

Model 2B. 24-Hour Rule Model, Maximum 15 Consecutive Hours of On-Duty Time								
Week	Sun	Mon	Tue	Wed	Thu	Fri	Sat	Weekly Total
I	10 drv 5 on 8 off 1 drv	9 drv 5 on 8 off 2 drv	8 drv 5 on 8 off 3 drv	7 drv 5 on 8 off 4 drv	6 drv 18 break	6 break 10 drv 5 on 3 off	5 off 10 drv 5 on 4 off	70 drv 30 on
II	4 off 10 drv 5 on 5 off	3 off 10 drv 5 on 6 off	2 off 10 drv 12 break	12 break 10 drv 2 on	3 on 8 off 10 drv 3 on	2 on 8 off 10 drv 4 on	1 on 8 off 10 drv 5 on	70 drv 30 on
III	8 off 10 drv 6 break	18 break 6 drv	4 drv 5 on 8 off 7 drv	3 drv 5 on 8 off 8 drv	2 drv 5 on 8 off 9 drv	1 drv 5 on 8 off 10 drv	24 break	60 drv 20 on
IV	10 drv 5 on 8 off 1 drv	9 drv 5 on 8 off 2 drv	8 drv 5 on 8 off 3 drv	7 drv 5 on 8 off 4 drv	6 drv 18 break	6 break 10 drv 5 on 3 off	5 off 10 drv 5 on 4 off	70 drv 30 on
V	4 off 10 drv 5 on 5 off	3 off 10 drv 5 on 6 off	2 off 10 drv 12 break	12 break 10 drv 2 on	3 on 8 off 10 drv 3 on	2 on 8 off 10 drv 4 on	1 on 8 off 10 drv 5 on	70 drv 30 on

Model 3A. Baseline Model of 70 Hours in 8 Days Rule, "Normal" 15 Hour Work Day								
Week	Sun	Mon	Tue	Wed	Thu	Fri	Sat	Weekly Total
I	9 off 10 drv 5 on	9 off 10 drv 5 on	9 off 10 drv 5 on	9 off 10 drv 5 on	9 off 10 drv 5 break	24 break	24 break	50 drv 20 on
II	24 break	9 off 10 drv 5 on	9 off 10 drv 5 on	9 off 10 drv 5 on	9 off 10 drv 5 on	9 off 10 drv 5 break	24 break	50 drv 20 on
III	24 break	24 break	9 off 10 drv 5 on	9 off 10 drv 5 on	9 off 10 drv 5 on	9 off 10 drv 5 on	9 off 10 drv 5 break	50 drv 20 on
IV	24 break	24 break	24 break	9 off 10 drv 5 on	9 off 10 drv 5 on	9 off 10 drv 5 on	9 off 10 drv 5 on	40 drv 20 on
V	9 off 10 drv 5 break	24 break	24 break	24 break	9 off 10 drv 5 on	9 off 10 drv 5 on	9 off 10 drv 5 on	40 drv 15 on

Model 3B. 24-Hour Rule Model, "Normal" 15 Hour Work Day								
Week	Sun	Mon	Tue	Wed	Thu	Fri	Sat	Weekly Total
I	9 off 10 drv 5 on	9 off 10 drv 5 on	9 off 10 drv 5 on	9 off 10 drv 5 on	9 off 10 drv 5 break	24 break	9 break 10 drv 5 on	60 drv 25 on
II	9 off 10 drv 5 on	9 off 10 drv 5 on	9 off 10 drv 5 on	9 off 10 drv 5 break	24 break	9 break 10 drv 5 on	9 off 10 drv 5 on	60 drv 25 on
III	9 off 10 drv 5 on	9 off 10 drv 5 on	9 off 10 drv 5 break	24 break	9 break 10 drv 5 on	9 off 10 drv 5 on	9 off 10 drv 5 on	60 drv 25 on
IV	9 off 10 drv 5 on	9 off 10 drv 5 break	24 break	9 break 10 drv 5 on	9 off 10 drv 5 on	9 off 10 drv 5 on	9 off 10 drv 5 on	60 drv 25 on
V	9 off 10 drv 5 break	24 break	9 break 10 drv 5 on	9 off 10 drv 5 on	9 off 10 drv 5 on	9 off 10 drv 5 on	9 off 10 drv 5 off	60 drv 20 on

Model 4A. Baseline Model of 70 Hours in 8 Days Rule, "Normal" 12 Hour Work Day								
Week	Sun	Mon	Tue	Wed	Thu	Fri	Sat	Weekly Total
I	10 drv 2 on 12 off	10 drv 2 on 12 off	10 drv 2 on 12 off	10 drv 2 on 12 off	10 drv 2 on 12 off	10 drv 14 break	24 break	60 drv 10 on
II	24 break	10 drv 2 on 12 off	10 drv 2 on 12 off	10 drv 2 on 12 off	10 drv 2 on 12 off	10 drv 2 on 12 off	10 drv 14 break	60 drv 10 on
III	24 break	24 break	10 drv 2 on 12 off	10 drv 2 on 12 off	10 drv 2 on 12 off	10 drv 2 on 12 off	10 drv 2 on 12 off	50 drv 10 on
IV	10 drv 14 break	24 break	24 break	10 drv 2 on 12 off	10 drv 2 on 12 off	10 drv 2 on 12 off	10 drv 2 on 12 off	50 drv 8 on
V	10 drv 2 on 12 off	10 drv 14 break	24 break	24 break	10 drv 2 on 12 off	10 drv 2 on 12 off	10 drv 2 on 12 off	50 drv 8 on

Model 4B. 24-Hour Rule Model "Normal" 12 Hour Work Day								
Week	Sun	Mon	Tue	Wed	Thu	Fri	Sat	Weekly Total
I	10 drv 2 on 12 off	10 drv 2 on 12 off	10 drv 2 on 12 off	10 drv 2 on 12 off	10 drv 2 on 12 off	10 drv 14 break	10 break 6 drv 8 off	66 drv 10 on
II	10 drv 2 on 12 off	10 drv 2 on 12 off	10 drv 2 on 12 off	10 drv 2 on 12 off	10 drv 2 on 12 off	4 drv 20 break	4 break 10 drv 2 on 8 off	64 drv 12 on
III	10 drv 2 on 12 off	10 drv 2 on 12 off	10 drv 2 on 12 off	10 drv 2 on 12 off	10 drv 14 break	10 break 6 drv 8 off	10 drv 2 on 12 off	66 drv 10 on
IV	10 drv 2 on 12 off	10 drv 2 on 12 off	10 drv 2 on 12 off	10 drv 14 break	10 break 6 drv 8 off	10 drv 2 on 12 off	10 drv 2 on 12 off	66 drv 10 on
V	10 drv 2 on 12 off	10 drv 2 on 12 off	10 drv 2 on 12 off	4 drv 20 break	4 break 10 drv 2 on 8 off	10 drv 2 on 12 off	10 drv 2 on 12 off	64 drv 12 on

Model 4C. 24-Hour Rule Model, 12 Hour Nonrhythmic Work Day								
Week	Sun	Mon	Tue	Wed	Thu	Fri	Sat	Weekly Total
I	10 drv 2 on 12 off	10 drv 2 on 12 off	10 drv 2 on 12 off	10 drv 2 on 12 off	10 drv 2 on 12 off	10 drv 14 break	10 break 10 drv 2 on 2 off	70 drv 12 on
II	6 off 10 drv 2 on 6 off	2 off 10 drv 2 on 10 off	10 drv 2 on 12 off	10 drv 2 on 12 off	10 drv 14 break	10 break 10 drv 2 on 2 off	6 off 10 drv 2 on 6 off	70 drv 12 on
III	2 off 10 drv 2 on 10 off	10 drv 2 on 12 off	10 drv 2 on 12 off	10 drv 14 break	10 break 10 drv 2 on 2 off	6 off 10 drv 2 on 6 off	2 off 10 drv 2 on 10 off	70 drv 12 on
IV	10 drv 2 on 12 off	10 drv 2 on 12 off	10 drv 14 break	10 break 10 drv 2 on 2 off	6 off 10 drv 2 on 6 off	2 off 10 drv 2 on 10 off	10 drv 2 on 12 off	70 drv 12 on
V	10 drv 2 on 12 off	10 drv 14 break	10 break 10 drv 2 on 2 off	6 off 10 drv 2 on 6 off	2 off 10 drv 2 on 10 off	10 drv 2 on 12 off	10 drv 2 on 12 off	70 drv 12 on

A summary of the number of hours of driving and total on-duty time including driving are presented in Table 1. The 70-in-8 rule is compared with the 24-hour rule for the five different scenarios. The comparison was made for a sixteen day period for all five scenarios. This period was selected for two reasons. First of all many over-the-road drivers, for which the "24-hour" rule would have the most impact, are gone for one or two weekends or more at a time thus it represents a realistic time period. The second reason is to simplify comparison of the two systems since the baseline existing rule is based on eight days.

The "24-hour" rule provided the opportunity for drivers to put in more time driving in every scenario. The greatest relative increase was observed in scenario 2 where driving time increased 56.0 percent (Table 1). The smallest relative increase in driving time was observed in scenario 4 which was still very significant at 25.0 percent. It should be pointed out that this increase was obtained at the same time a very rhythmic schedule was achieved allowing a driver to drive during the same hours every 24-hour period over several days, and to be off-duty during the same period of time during the day throughout their trip. The increase in the amount of absolute driving time gained ranged from 60 hours in scenario 1 to 30 hours in scenario 4. The models will be utilized in the succeeding sections to

analyze the impact that the "24-hour" rule could have on economic efficiency, the driver, and, to a limited extent, safety.

Table 1. Summary of Driving and On-Duty time for the Models and A Comparison of the 70-in-8 and 24-Hour Rule Scenarios						
Scenario	Model #	Description	16 Day Total Driving Time (hours)	Change in Driving Time (hours) (%)		Total 16 Day On-Duty Time (hours)
1	1A	70-in-8, 10 hours continuous straight driving	140	60	42.8	140
	1B	24-hour, 10 hours continuous straight driving	200			200
2	2A	70-in-8, 15 hours continuous on-duty time	100	56	56.0	140
	2B	24-hour, 15 hours continuous on-duty time	156			216
3	3A	70-in-8, 15 hour normal work day	100	40	40.0	150
	3B	24-hour, 15 hour normal work day	140			210
4	4A	70-in-8, 12 hour normal work day	120	30	25.0	140
	4B	24-hour, 12 hour normal work day	150			176
5	4A	70-in-8, 12 hour normal work day	120	40	33.3	140
	4C	24-hour, 12 hour nonrhythmic work day	160			188

It should be pointed out that these potential gains in efficiency, driving time, and time at home are hypothetical and in the final analysis, if the 24-hour rule were adopted, would be modified by the operational realities of the truckload business.

IMPACT ON EFFICIENCY

The 24-hour rule has the potential to significantly reduce the amount of idle time spent on the road by drivers as is shown in the various models. This reduction could result in anywhere from thirty to sixty hours of additional potential driving time in a sixteen day trip depending on the scenario. This increase in driving time has significant implications for productivity and efficiency in many different areas of the trucking industry.

Utilization of Equipment

Equipment is a significant cost factor in operating a truckload trucking firm. Money spent on tractors and trailers constitutes the single largest capital investment requirement for such a company. A typical tractor will cost anywhere from \$60,000 to \$130,000 and a trailer will range from \$15,000 to \$50,000 depending on the type (van, reefer, flatbed, etc.). This does not take into account very specialized equipment which can be much more expensive. Increased utilization of this equipment will result in decreased investment costs for the industry.

The magnitude of this reduction due to the 24-hour rule is not easy to estimate for the industry. However one may approach the question from the total U.S. bill for intercity truck freight movements which have been estimated at \$151,290,000,000.² Assuming that one-third of that bill was for for-hire, truckload movements would mean that 50 billion dollars a year is spent by shippers to move freight via the truckload industry. Assuming an average rate of approximately one dollar per mile this would result in a total annual mileage of 50,000,000,000 miles. If one assumes that the average mileage for a tractor in a year is 110,000 miles³ a minimum total fleet of 454,545 tractors would be required to provide the necessary capacity in power for that amount of mileage.

Making another simplifying assumption that the average investment in a tractor and trailer is \$90,000 means a total investment of \$40,909,050,000. At an interest rate of ten percent this results in

²Frank A. Smith, Transportation in America - A Statistical Analysis of Transportation in the United States, Eno Transportation Foundation, Inc., 1991, p. 40.

³Rodriguez, Julene and Gene Griffin, A Survey of Commercial Drivers Opinions of What They Consider Important in Their Job, Upper Great Plains Transportation Institute, July 1991, A survey of 3,910 reported annual mileage of 109,454 miles.

interest costs or opportunity costs in the neighborhood of 4.1 billion dollars per year. An increase in equipment productivity of merely 25 percent (scenario 4) would result in savings for the industry of one billion dollars.

This estimate is probably conservative, based on the stated assumptions given, because it does not take into account private carriage or other trucking operations such as less than truckload operations. It also does not account for the excess equipment required to run a service responsive company. On the other hand, the estimate may be inflated because of the existing operational characteristics of the industry. Some efficiency gains are probably already achieved because of non-compliance with the existing regulation. Furthermore, the model assumes that each additional hour gained will be used productively which is unlikely. Eight managers of truckload carriers were asked what they thought the increase in productivity in equipment would be. Their responses ranged from two to ten percent. The carriers who would experience the greatest increase in productivity are (1) those whose drivers stay out the longest, (2) those companies who presently require drivers to be in compliance with the existing 70-in-8 rule, and (3) companies who would provide more home time for drivers as a result of the increased flexibility, but switch from assigned to non-assigned equipment. On balance, it appears that there are potentially, significant gains in equipment utilization that would not require the driver to be home less time than they currently are, and in certain situations could be home more.

It should be emphasized that the increased utilization of equipment that is hypothetically demonstrated in this study does not result from keeping the driver on the road by reducing the amount of time the driver would spend at home. The efficiency gains are calculated on an average sixteen day period on the road. If drivers return home, on average, every sixteen days and have the same amount of home time as prior to a potential rule change, the hypothetical efficiency gain would be 25 percent for the scenario cited. The efficiency gains result from the drivers being able to better utilize their time while on that sixteen day trip.

Reduction in Transit Time

The goal of carriers and shippers alike for many years has been to reduce transit time for freight as a means of improving overall service. This provides for increased productivity for the carrier and reduced inventory costs for the shipper or receiver, thus it is a win-win environment. The amount of actual reduction in transit time by the 24-hour rule is speculative, however, a hypothetical example based on industry standards can be illustrated. The average length of haul reported by drivers in a survey representative of the truckload industry was 1,080 miles.⁴ Assuming an average speed of 50 miles per hour, this trip would require 21.6 hours of driving. This is certainly within the range of the Model 4A — 70-in-8 rule if a driver picks up the load before they have accumulated less than 48 hours. However, assume that a driver would pick up the load on Friday of week one in Model 4A (70-in-8 normal twelve hour work day). Total transit time for that particular load would be 4 days and 1.6 hours or 97.6 hours because of the shut down (restriction on driving) required by the 70 hour maximum. The transit time required for the same load under Model 4B (24-hour normal twelve hour work day) assuming the same pick up time, would be 2 days and 5.6 hours or a total of 53.6 hours, a reduction of 44 hours or 45 percent. Obviously this would not occur on every load but this is an example of what could happen. A 24-hour rule could result in a dramatic reduction in transit time and definitely more consistency in transit time.

The consistency would result from drivers not having to shut down for more than 24 hours. Again, using Models 4A and 4B, average trip length of 1,080 miles and average speed of 50 miles per hour, a total of 2 days and 1.6 hours would be required assuming that the driver picked up the trip with less than 48 hours of on-duty time accumulated. (This also implicitly assumes that the driver had a regular schedule the prior eleven days.) A shipper or receiver, thus, would expect to receive delivery roughly within a 48-hour time period after shipment. However, if a driver picked up the shipment in Model 4A with more than 48 hours accumulated driving and on-duty time as in the previously cited example, the transit time would again be 4 days and 1.6 hours, or roughly 96 hours.

⁴Op. Cit.

With the 24-hour restart provision, that transit time would be reduced to 2 days and 5.6 hours, which is much more consistent with the 48-hour time period expectation of shippers/receivers.

Cargo and Equipment Risk Implications

Another positive benefit of reduced transit time is the reduction in the risk of theft and vandalism to the tractor, the trailer, and its contents. Additional waiting time on the road increases the exposure of the tractor/trailer and the freight to theft and vandalism. Although it is not the intent of this study to quantify the gains in this area resulting from a shift to a 24-hour rule it is intuitively obvious. A survey of truckload drivers indicated the same.⁵ Forty-six percent of drivers thought there was an increased risk in the security of their tractor, trailer, and cargo when off-duty time exceeded 24 hours (see Appendix C for a description of the survey and procedure). Specifically, 16.5 percent of the drivers surveyed thought there was a "significant increase" in risk beyond 24 hours, 29.5 percent thought it results in a "moderate increase" in risk and 46.3 percent did not think off-duty time over 24 hours on the road impacts the security in any way. Only a small fraction, approximately eight percent, thought more off-duty time reduces risk. The result of reduced risk would be improved reliability of shipments, reduced insurance claims and resulting premiums. This would produce all around better service and an improved working environment for the driver.

Improved Scheduling Flexibility

The 24-hour rule would improve scheduling flexibility significantly over the 70-in-8 regulations. Using models 4A and 4B for comparison there is an additional four days for picking up or delivering a load in each sixteen day period. This is a twenty-five percent increase in the number of days in which a truck is available for dispatch. From a logistical perspective this increases the number of choices a scheduler has to work with in matching available power with current demand for trucks. This is not only a benefit to the trucking company but it is a positive benefit to the driver whether they

⁵The survey respondents were stratified by the amount of time they were on the road. The survey data in this report reflects opinions of those drivers gone for two weekends or more. This selection was made because drivers who have longer periods on the road actually experience times when they have to stop driving because of the 70-in-8 rule and they were thought to have a better understanding of the current rule, the change and its implications. Furthermore, drivers who are gone at least two weekends will be out for at least eight days which the rule revolves around.

are an independent contractor or company driver. The most common method of payment for drivers is by the mile or a percentage of the freight bill. If drivers are prohibited from picking up a load because they have run out of hours, they are denied potential opportunities for additional work and income. Similar to an empty airplane seat which has zero value once the plane has departed, an available load dispatched to another driver/carrier is gone forever.

Drivers are not only scheduled for loading, but also for the time for delivery and unloading, which is just as, or more important than scheduled loading. This is particularly true for many types of manufacturing operations requiring just-in-time delivery or narrow delivery windows. The improved scheduling flexibility would provide more options in meeting narrow delivery windows for schedulers and drivers alike, since drivers have some prerogative in when they choose to drive and go off-duty.

There could be some safety implications for this as well, which will be addressed here instead of the safety section, assuming a driver runs out of cumulative hours 400 miles from his/her destination on Friday of week I in Model 4A. It should also be assumed that the driver is scheduled to make an 8:00 a.m. delivery on Monday of week II. If the driver is working a midnight to midnight log, that would mean that he/she would have to start driving at midnight on Monday of week II and drive all night to make the 8:00 a.m. delivery. If the driver has scheduled themselves around day-time driving, this would definitely put them out of their normal rhythm. The 24-hour restart provision would allow the driver to have the load at destination ready for delivery on midday Sunday in Model 4B, allowing for daytime driving only.

Improved Retention of Drivers

Turnover of drivers in the truckload trucking industry has been a major problem for several years. Turnover rates of 100 percent are not uncommon for truckload carriers and sixty-five percent could easily be the norm. This turnover is an expensive proposition for the industry, drivers, and society. There are estimates that turnover costs range from \$2,000 to \$12,000 per driver.

Assuming a carrier has 100 drivers, an average cost of \$5,000 per turnover, and 65 percent turnover, this would mean a cost of \$325,000 annually. Assuming that each driver generates approximately \$100,000 in revenue per year (100,000 miles x \$1/mile), the turnover costs

approximate 3.25 percent of gross revenue. At a 100 percent turnover rate, that figure is closer to 5 percent. Anything that can be done to reduce turnover and increase retention will improve the bottom line of the company. It will also reduce unemployment rates and the associated social costs.

One of the reasons for turnover is drivers' expectations not being met when they start working. In a survey of owner operators, 39.4 percent expected more pay and 47.1 percent expected less time waiting.⁶ A similar study of mostly company drivers revealed 60.0 percent of the drivers expected less time waiting, and 47.8 percent expected more income.⁷ The 24-hour rule would have a positive impact on both of these issues since it would reduce the amount of on-the-road off-duty time (waiting time) which in turn increases the number of miles they can put on. Thus, the 24-hour rule could have a positive impact on both income and waiting time resulting in increased job satisfaction, in turn, leading to improved retention. Both of these attributes will be explored more fully in the next section.

⁶Griffin, Gene and Julene Rodriguez, Creating a Competitive Advantage through Partnershipping with Owner-Operators, Upper Great Plains Transportation Institute, NDSU, June, 1992, No. 91, pg. 38.

⁷Ibid.

IMPACT ON DRIVERS

It is obvious that the 24-hour rule could have a major impact on drivers in several areas including income, time at home, regularity of schedule, idle time on the road, and mental attitude, as well as other areas. The purpose of this section is to explore, quantify and qualify where possible, those impacts.

Potential for Increased Income

Drivers are generally paid on a piecework basis (i.e., by the mile or a percentage of the freight bill). Therefore, their income is proportional to the amount of time they can put in driving and is adversely affected by time spent on the road waiting regardless if their waiting is caused by slow dispatch or because they have run out of hours. All the various models indicated that under the 24-hour rule a driver will get more time on the road for each scenario presented. There was overwhelming support of this thesis by the survey of drivers for this study. Drivers were asked, "How do you think this rule change would affect your income?" Seventy-two percent of the drivers thought the rule change would increase their income. Approximately one-fourth of the drivers thought it would result in no change and only four percent thought the rule change would result in decreased income.

To estimate what the potential increase would be, one must make some simplifying assumptions concerning how much time the driver spends on the road annually. Data was reviewed on the average time on the road from the two previously cited studies. Since the possible rule change would primarily have the greatest effect on long distance drivers who are normally out at least one weekend, only those drivers were considered when estimating the average time out before returning home. Of those drivers on the road one weekend or more, the average driver was gone a little over two weekends in the study which consisted mostly of company drivers, the same was true of owner-operators. This would indicate that drivers, on the average, are out approximately somewhere between 15 to 18 days. Obviously since this is an average, some are out less and some are out longer as the data indicates. Assuming that drivers are out for 16 days at a time and that they take 4 days off

when they return home, the average trip cycle, including time at home is 20 days. This would result in 18.25 trips per year or a total of 292 days of driving.

The increased income potential under the five scenarios are presented in Table 2, based on 292 days of driving. Model 4A seems to be the most representative of the 70-in-8 models since it reflects the average number of miles driven reported by drivers in the survey of company drivers.⁸

When Model 4A is compared with Model 4B as shown in Table 2, this scenario would result in a twenty-five percent increase in income. This of course assumes, as it does for all models, that the driver uses the additional time gained driving instead of using it for resting or additional home time which are also options for the driver. Again, it should be emphasized that this increase in income is achieved without reducing the amount of time spent at home.

Potential for Increased Time at Home

It is probably unlikely that a driver would be able to utilize all the time gained under a 24-hour rule at home as it is unlikely that the driver would end up driving all the additional time. However, it is useful for purposes of comparison to calculate the time gained that can potentially be used for increased home time to illustrate the outside boundaries of the potential. Using the 292 day annual driving regimen utilized in the previous section, a

⁸Op. Cit

Table 2. Estimates of Potential Increase in Driver Income Resulting from 24-hour Rule for Five Different Scenarios

Model	Description	Annual Driving Time ^a (hours)	Annual Miles ^b	Annual Income ^c (dollars)	Difference in Income (dollars)	Percentage Increase
1A	70-in-8, 10 hours straight driving	2,555	127,750	33,215	14,235	42.8
1B	24-hour, 10 hours straight driving	3,650	182,500	47,450		
2A	70-in-8, 15 hours on-duty time	1,825	91,250	23,725	13,286	56.0
2B	24-hour, 15 hours on-duty time	2,847	142,350	37,011		
3A	70-in-8, 15 hour normal workday	1,825	91,250	23,725	9,490	40.0
3B	24-hour, 15 hour normal workday	2,555	127,750	33,215		
4A	70-in-8, 12 hour normal workday	2,190	109,500	28,470	7,111	25.0
4B	24-hour, 12 hour normal workday	2,737	136,850	35,581		
4A	70-in-8, 12 hour normal workday	2,190	109,500	28,470	9,490	33.3
4C	24-hour, 12 hour nonrhythmic workday	2,920	146,000	37,960		

a. Based on 292 days on the road annually.

b. Based on an average speed of 50 miles per hour.

c. Based on a rate of pay of 26 cents per mile.

driver would have the potential of picking up 73 days of additional time under the 24-hour rule under the 4A-4B scenario. This results from the four days in which no driving or on-duty time is accumulated during the sixteen day cycle in Model 4A multiplied by the number of sixteen day cycles in 292 days which is 18.25. This is compared to Model 4B in which a driver can work some part of every day under the 24-hour rule and still maintain a rhythmic cycle allowing for an off-duty period during the late night hours. It should be noted that a driver may presently spend some of their required off-duty time, under the 70-in-8 rule, at home which would reduce this estimate, however, it is important to define the boundaries of possibility.

Drivers which were surveyed were split on their opinion of the impact that the rule change would have on their amount of time at home. Drivers were asked, "How do you think this rule change would affect the amount of time you spend at home?" Thirty-two percent felt that it would result in a substantial to moderate increase, the majority, forty-nine percent, thought it would have no impact and nineteen percent thought it would have a moderate to substantial decrease. Similarly,

when drivers were asked what impact such a rule change would have on the quality of their home time, forty-five percent thought it would have no impact. However, thirty-eight percent thought it would have a positive impact on the quality of their home time compared to eighteen percent who thought it would detract.

It is difficult to imagine that a trucking firm would be able to require drivers to use all the additional time for driving. Given the importance of the issue of time at home in turnover (it was cited as the second most frequent reason for leaving the industry in the UGPTI Job Satisfaction Study), the cost of turnover, the shortage of drivers, and the competitive nature of the industry, it would seem unlikely that it would be possible for a company to adopt strategy requiring the driver to spend all additional time gained as a result of the 24-hour rule on the road driving.

Furthermore, it is nearly impossible to imagine a company reducing the amount of home time a driver experiences as a result of the 24-hour rule. It is the experience of the authors that getting drivers home is a major issue with companies that want to keep drivers and stay in business. Such a strategy would most likely result in increased turnover and a deterioration of job performance, which would have a negative impact on the viability of the company. It is more likely that the additional time gained would be split between increased driving (and corresponding income) and increased time at home or at least no less time at home than under the 70-in-8 rule.

Improved Regularity of Schedule

A driver, after having been off-duty for as many as almost three full days in some cases, can only drive a few hours on the fourth day because of the nature of the 70-in-8 rule. The 70-in-8 rule, as was pointed out earlier, is a cumulative running total which prohibits a driver from driving after accumulating 70 hours of on-duty time, including driving and other work related activity, in any eight day period. For purposes of computing whether a driver is in compliance, a driver must always consider how much total on-duty and driving time they have had the previous seven days. For example, if a driver has worked 66 hours in the previous seven days, they can only drive 4 hours on the eighth day regardless of how much off-duty time they have experienced just prior to the current work day.

Table 3 illustrates this problem. Assume that a driver spends a Sunday with their family and has decided to leave at 6:00 p.m. after an early dinner with them. Further assume that the driver had a full weekend of family activity and becomes tired after four hours of driving and decides to go off-duty at 10:00 p.m. and rests until 6:00 a.m. on Monday when he/she goes back on-duty and begins driving. One can follow the remainder of the schedule through the eight day period noting a delivery and pick up after approximately 500 miles on Monday (3 hours on-duty, no driving) and a similar situation on Thursday after approximately 1,400 miles (4½ hours on-duty, no driving).

This schedule allows the driver to be off-duty and presumably rest during the night and be off the road between 10 p.m. and 4 a.m. You will note that the driver accumulates 70 hours at 11:30 a.m. on Saturday and must shut down for a total of 42½ hours before being able to go on-duty at 6:00 a.m. on Monday of week II. Although the driver has had nearly two full days of rest, only four hours are available for driving on Monday before they have to shut down again because of their work activity the previous seven days. Under the 24-hour rule a driver would be able to maintain the rhythm of daytime work by going on-duty at 11:30 a.m. the next day. It should be pointed out this is not the worst case scenario. A driver who is capable of utilizing the continuous hours of service rules to the maximum extent possible would accumulate 70 hours much sooner and would be faced with more off-duty time than is represented in this hypothetical case and still be able to drive only 4 hours on the ninth day.

Another scheduling problem for drivers associated with the 70-in-8 rule is what is referred to as "picking up zeros." This is similar to the example just cited but results in a driver having to shut down for a day or two in the middle of an eight day period although they have only been driving for 2 or 3 days. Picking up zeros relates to the amount of time available to be worked in a particular day. If nine days ago you drove zero hours, you would have zero hours available for driving today assuming that you are maintaining 70 hours of accumulated time.

Drivers were asked "How do you think this rule change would impact your driving schedule?" A large majority of drivers, sixty-five percent, felt that it would result in either a moderate or significant improvement in their driving schedule. A small percentage, only five percent, thought it

would have significant negative impact, and eight percent thought it would have a moderate negative impact with twenty-two percent thinking there would be no change.

Table 3. Hypothetical Driver Schedule Illustrating Scheduling Problems with 70-in-8 Rule							
Cumulative Hours	4	18	31	42	52.5	64.5	70
Week 1	SUN	MON	TUE	WED	THU	FRI	SAT
6:00 a -	↑	↑	↑	↑	↑	½ on	½ on
-				2 drv	↓	↓	↓
-			4 drv	↓	5 drv	5½ drv	5 drv
-		6 drv	↓	↓	↓	↓	↓
-			2 off	1½ off	2 off	↓	↓
12:00 N -	12 off	↓	↓	½ on	↓	2 off	out of hours
-		1 off	↑	↑	↓	↓	
-		3 on	6 drv	6 drv	4½ on	½ on	
-		↓	↓	↓	↓	↑	
6:00 p -	↓	↑	↓	½ on	1 drv	4½ drv	18½ off
-	4 drv	4 drv	1 on	↑	11½ off	↓	
-	↓	↑	↑			↑	
12:00 M -	↑	9 off	9 off	11½ off		10 off	
-	8 off						
-		↓	↓	↓		↓	
-	↓	1 drv	2 drv	2 drv		1 drv	
-							
Cumulative Hours	4	18	31	42	52.5	64.5	70
Week 2							
6:00 a -		↑	↓	↓	↓		
-		4 drv					
-		↓					
-		↑					
-		out of hours					
12:00 N -		hours					
-		↓					
-	24 off						
6:00 p -		20 off					
-							
12:00 M -							
-							
6:00 a -		↓					
Cumulative Hrs.	70 Hrs	70 Hrs					

A related question addressed the effect that too much off-duty time has on a driver's attitude. Specifically, drivers were asked, "After you have rested, how does additional off-duty time on the road impact your attitude?" A majority of drivers, forty-nine percent, indicated that it made their attitude worse or much worse. Thirty-two percent thought it would improve their attitude with the remainder of the respondents, nineteen percent, feeling that it would have no impact. If a good attitude is positively related to safety, one may conclude that this aspect of the 24-hour rule would have a positive impact on safety.

Other Impacts

The greater scheduling opportunities that flow from a 24-hour rule are also a benefit to a company driver or owner-operator. As was pointed out earlier, a potential load dispatched to some other firm or driver, when a driver is off-duty because they have run out of hours, is a missed opportunity.

Another additional benefit of the 24-hour rule is the reduction in on-the-road subsistence costs. Expenses such as food, lodging, and entertainment will most likely increase when a driver is off-duty as compared to on-duty. This presents a special problem because a driver's expenses increase at the very time that they are not earning any income.

IMPLICATIONS FOR SAFETY

The implications for safety are the most difficult to determine. The fundamental reason for this is the complicated nature of safety issues and the lack of appropriate accident data to analyze. A search for secondary accident data that would be useful in addressing the issue of the implications that the 24-hour rule would have on safety was made at the state and federal level. No data was identified that would be statistically valid. Given that secondary data did not exist and that primary accident data collection for such analysis would take years to collect, an alternative was sought. The only primary data thought feasible to collect within the time frame of the study was from drivers regarding their opinions pertaining to certain safety aspects of the 24-hour rule. The implications for safety have been addressed several different ways in this section, including a driver survey, personal interviews and site visits with people involved in the trucking industry in California and Florida, a telephone survey of oil field carriers and a telephone survey of people familiar with the Alberta and Saskatchewan intraprovincial rules and their implications for safety. Furthermore, the impact that a 24-hour rule has on providing a more rhythmic schedule is also addressed.

Driver Survey

A driver survey was conducted regarding several implications of adopting a 24-hour restart provision. This was accomplished by asking the front line worker, who is closest to the situation, what they think the impact of such a rule change would be. The survey, methodology and the full results can be found in Appendix C. The respondents utilized for the following discussion are gone two weekends or more. This group was selected because this rule change will impact the long distance irregular route truckload driver much more than other types of drivers, and because a driver gone two weekends or more is assured of being out at least eight days, which is the time period the 70-in-8 rule revolves around.

One of the safety questions relates to the activities drivers may involve themselves in after 24 hours of off-duty time. The reason for this question was because of the supposition that drivers, after they have rested sufficiently, may get involved in activities that would affect their ability to drive safely, particularly if they became bored. The specific question asked was "How does more than 24-

hours off-duty time on the road affect **your** behavior with regard to proper rest and acceptable activities?" Seventeen percent said more than 24 hours off-duty had a very negative impact on proper rest and activities, and twenty-three percent indicated it had somewhat of a negative impact for a combined total of forty percent. Twenty-four percent said it would have no impact. Thirty-six percent said that more than twenty-four hours had a somewhat positive to very positive impact. A key finding of this study is that nearly forty percent of the drivers, by their own admission, do not rest properly and/or become involved in activities which are negative regarding proper rest after 24 hours off-duty. One could speculate that the drivers that indicated some positive impact are those that need more rest, simply like the time off, and/or use the time in a positive way. It should be pointed out that these drivers, those that use the extra time in a positive manner, do not pose a safety problem in any event unless they are forced to drive when they need additional rest. It could be argued that companies which would engage in the practice of forcing a driver to drive when not rested, probably do so under the current rules. The main point is that the 24-hour rule would have a positive impact on approximately forty percent of drivers regarding their off-duty behavior on the road.

The same question was asked regarding drivers opinions of **other** drivers. Fifty percent of the respondents felt that other drivers behavior was negatively affected by more than 24 hours off-duty as compared to a positive impact on thirty-five percent. In this case, drivers as a rule thought other drivers were affected slightly more adversely.

As was pointed out earlier, a significant majority of drivers felt that additional off-duty time after they have rested properly, had a negative impact on their attitude as opposed to positive (forty-nine percent versus thirty-two percent). The question that needs to be asked is, "Does attitude affect the ability of a driver to perform safely?" If it does, then being off-duty beyond a certain amount of time will have a negative impact on safety.

A direct question regarding the impact this rule would have on safety was also asked. Drivers were asked, "What effect do you think this rule change would have on driving safety?" A majority of respondents, fifty-one percent, thought it would make safety better or much better. Thirty-three percent thought it would have no impact on safety and only seventeen percent thought it would have a negative impact on safety.

A final safety related question was asked, "Do you feel that you use your extra off-duty time on the road in a positive or negative manner?" Twenty-three percent of the respondents felt that they used extra time in a negative manner while fifty-one percent thought they used extra time in a positive way. This data correlates to some degree with the attitude revealed in earlier questions.

In summary, many drivers generally feel that excessive time off-duty is a problem and a majority, eighty-three percent, feel that the 24-hour restart provision would improve or have no impact on safety.

Site Visits to Florida and California

Florida and California were selected for site visits because the state laws which govern drivers hours of service on intrastate truck commerce are different from the federal regulations, and because they are large states in terms of population, size, and traffic. California allows drivers up to sixteen total on-duty hours with as many as twelve hours driving (Appendix D). California does not have, however, a 24-hour restart provision for the cumulative hours of service. Florida law on intrastate movements modifies both the consecutive hours of service and the cumulative hours of service regulations (Appendix D). Florida intrastate drivers are allowed to drive any part of 15 hours on-duty after 8 consecutive hours off-duty. Furthermore, they can accumulate 72 hours in a 7 day period or 84 hours in an 8 day period before having to quit driving. Finally the 24-hour restart provision applies wherein "24 consecutive hours off-duty shall constitute the end of any such period of 7 or 8 consecutive days."

A site visit was made to the California Trucking Association to assess the availability of statistical data which could be analyzed to determine if the longer consecutive hours of service had an impact on accident rates and related safety measures. Not only was there no data to work with, it seems unlikely that if there were data regarding intrastate versus interstate that one would be able to perform an appropriate statistical analysis. Issues such as the efficacy of the carriers safety programs, profitability, driver wages, operating characteristics, and laws would make it difficult to compare 'apples with apples'. However, discussions held with staff of the California Trucking Association indicated that they were not aware that the state laws governing intrastate hours of service caused

increased safety problems. This conclusion was based on several conversations they had with management personnel working for trucking companies which had intrastate operations.

A similar visit was made to the Florida Trucking Association with the same objectives in mind. The availability of data was the same in Florida as in California (nonexistent) and the same concerns of conducting a valid statistical analysis were true as well. However a meeting was held with the director and assistant director of the Florida Office of Motor Carrier Compliance. Both of them were very adamant that the Florida regulations did not result in increased safety problems with intrastate trucking. Furthermore the director indicated that if he had any indication or feeling that such was the case that he could strongly recommend a change to the Florida legislature. The director of operations of the Florida Trucking Association also indicated that he had the same opinion and furthermore he felt that the Florida laws improved safety.

What one can draw from these opinions is difficult to say and for certain it is anecdotal evidence as opposed to scientific. The best one might conclude is that it does not disprove the case that more liberal hours of service regulations do not result in an increased risk in safety, which is to say that as far as the authors could determine no negative evidence was discovered. It would also seem that if these regulations were causing safety problems, the necessary data to identify such problems would have been developed by the appropriate government agencies which is not the case.

Rhythmic Schedule

To the extent that the 24-hour restart provision can contribute to a rhythmic schedule, it should have a positive influence on safety. The 24-hour rule as utilized in model 4B does provide a rhythmic schedule while allowing the driver to put more hours driving in than Model 1A which is an irregular schedule under the 70-in-8 rule where the driver is working and resting at odd times during the course of sixteen days. If the more rhythmic schedule is more in tune with the circadian rhythm and this results in a safer driver, then the 24-hour restart provision could have a positive impact on safety. Furthermore, the driver would earn slightly more income under Model 4B as opposed to Model 1A which may have positive implications for safety as well. As one driver put it, "you push harder when you need the money."

Telephone Survey of Oil Field Carriers

An attempt was made to identify any difference in safety records for oil field companies operating under both the 70-in-8 and 24-hour rule. Six trucking firms were consulted that were identified as oil field companies. Specifically, the companies contacted were Waggoner's Trucking, Black Hills Trucking, Hi-Line Trucking, G & L Trucking, Pool Well Servicing, and Power Fuels, Inc. Oil field companies were selected because, as was stated earlier, these companies currently are allowed to utilize the 24-hour restart provision. Thus, they were seen as having enough experience with, and knowledge of, both rules to make an educated decision of which they believe has a better safety record.

Management personnel were first asked if they were familiar with both rules (all were) and then of the two rules, which they considered to have a better safety record. All six believed that there is little to no difference in safety between the two rules with several firms expressing favoritism towards the 24-hour restart provision.

Some comments were that the 24-hour rule utilizes drivers better and that drivers also prefer it. In addition, the statement was made that the 24-hour rule encourages more honesty from drivers (i.e., less cheating on the log books) and thus has a positive effect on safety. Another comment was that the 70-in-8 rule was developed when trucks weren't as convenient (i.e., no air conditioning, not as comfortable) as they are now and thus drivers were more prone to fatigue. Several also stated the opinion that if the driver wasn't fully rested after 24 hours off-duty, they wouldn't be more rested after additional time off.

Alberta and Saskatchewan Rules and Implications

Both government and industry personnel were contacted in Alberta and Saskatchewan to determine their opinions toward the two rules. These provinces were chosen as they currently have no cumulative hour rule (i.e., 70 hours in 8 days, etc.) for drivers within their province, but only a 13 hour driving / 15 hours total on-duty time rule in any given 24 hour period.

The representative contacted from the Alberta Transportation and Utilities Department stated that the impact on accident experience of not having a cap on driving hours per week is difficult to

determine, but believes that it is no detriment to safety. He said that all indications appear to point to lower accident rates under this rule, although he believed this may be somewhat due to better maintenance programs and enforcement procedures in recent years. He was able to provide the current hours-of-service regulations for Alberta which are presented in Appendix D.

A representative from the Alberta Trucking Association was also consulted. He was of the opinion that there are too many problems associated with having weekly maximums, such as the concern of drivers having too many days off in a strange town or taking longer to get back home. His industry favors the current rule although they also were in favor of cutting the number of hours worked in any given day to 10 instead of 15 so as to attract younger workers who he felt don't like the idea of working such long hours.

The Saskatchewan Highways and Transportation Department was also contacted and the representative there thought that there appears to be no identifiable reason for having a cap on driving hours in any given week. He did, however, believe that the current 13 hours driving / 15 hours on-duty time in any 24 hours is reasonable. He felt that there have been little or no studies completed in this area and that the caps per week are simply put in the regulations just because they always have been. He also stated that drivers should have the freedom to drive and work as long as they feel they are able and that there is no evidence available to support repression of this individual right. He continued by stating that there is also no evidence that the accident rate is any worse without the cap on driving hours than with it. He was unable to provide the current hours-of-service regulations for Saskatchewan, but stated that they are the same as the federal rules without the cap on the number of hours allowed to drive per week. These federal hours-of-service rules are also presented in Appendix D.

In addition, the Saskatchewan Trucking Association was also contacted and the representative there also had the opinion that there are problems with restricting cumulative totals and believes that not having this restriction has no effect on safety. He also believes that not having the restriction aids in dispatching and also allows drivers to be legal much easier (i.e., it doesn't force them to run illegally).